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(71) Applicant(s)

Robert Bosch GmbH  
(Incorporated in the Federal Republic of Germany)  
Wernerstrasse 1, Stuttgart-Feuerbach,  
D-70442 Stuttgart 30, Federal Republic of Germany

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(72) Inventor(s)

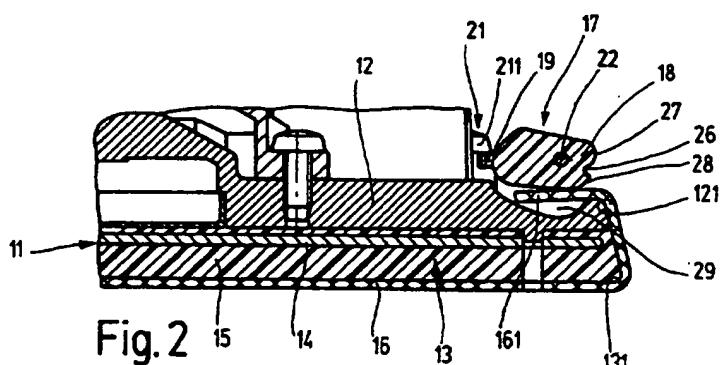
Julian Pfaundler

(74) Agent and/or Address for Service

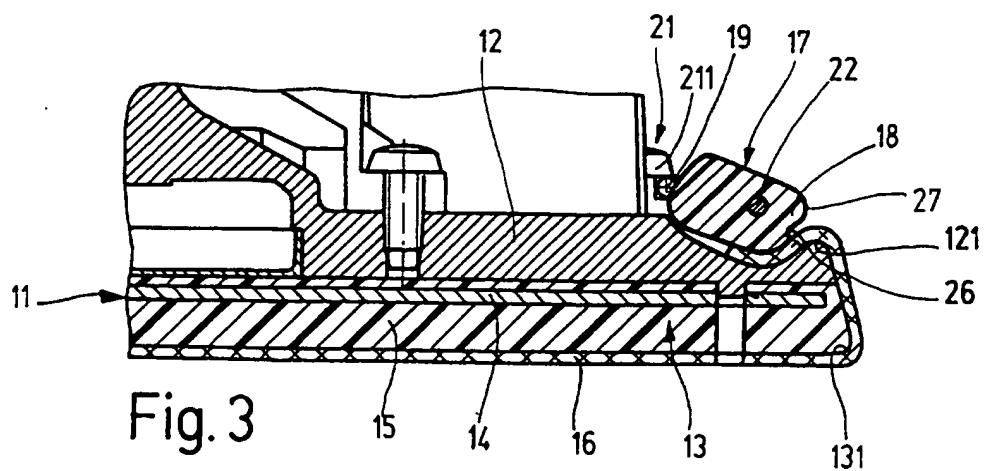
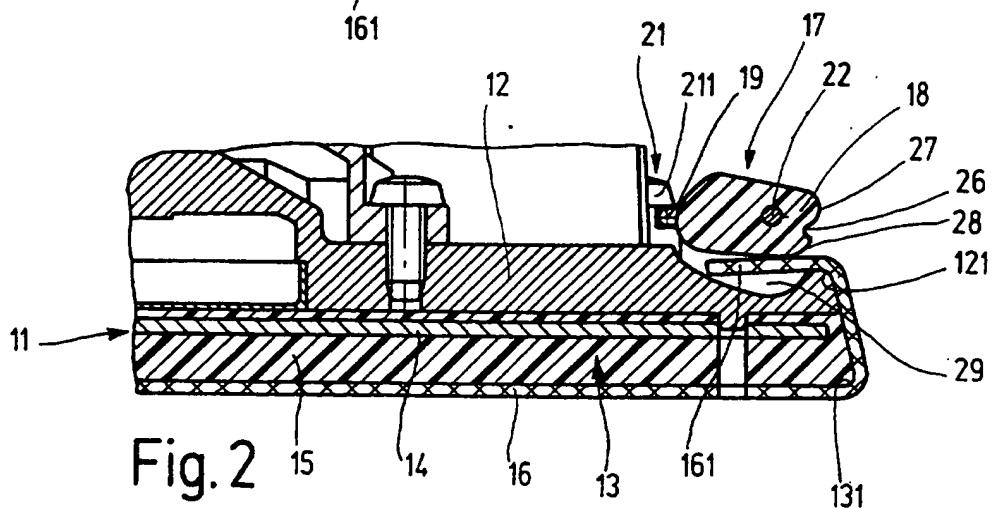
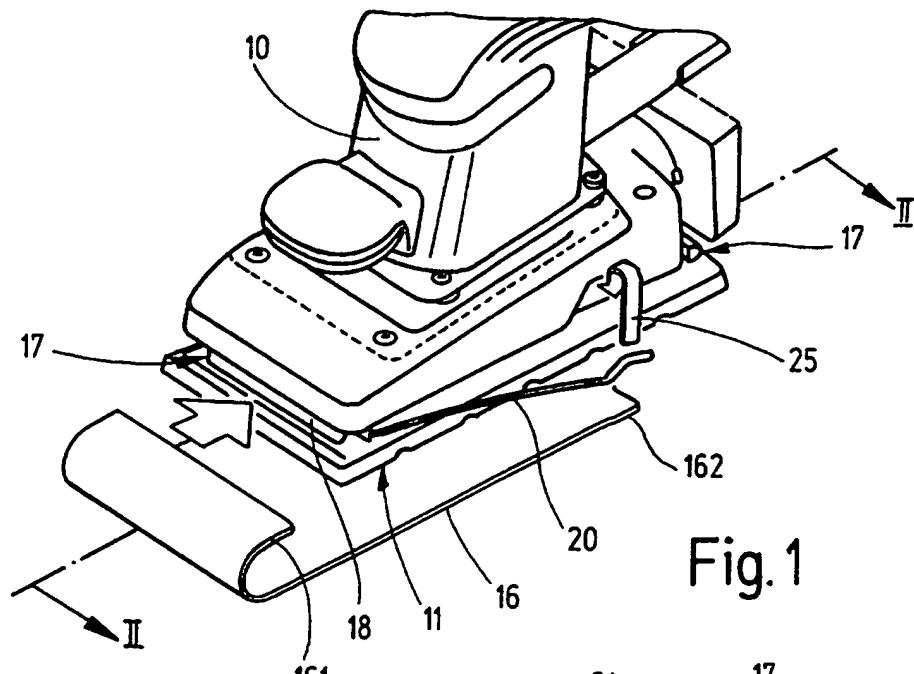
A A Thornton & Co  
Northumberland House, 303-306 High Holborn,  
LONDON, WC1V 7LE, United Kingdom

(54) Abstract Title  
Electric hand tool

(57) In an electric hand tool, in particular a sander, e.g. an orbital sander, having a motor-driven work plate (11) and clamping means (17) for firmly clamping on the work plate (11) an abrasive sheet (16) which overlaps the underside of the work plate (11), in order to achieve a permanently taut state of the abrasive sheet (16) at least one of the clamping bodies (18) which may be applied onto the sheet ends (161, 162) is formed from elastically deformable material and in the manner of a roller and is disposed so as to be capable of swivelling about an eccentrically disposed swivelling axis (30). The eccentricity of the swivelling axis (30) and the contour of the clamping body (18) are so selected that, with progressive swivelling of the clamping body (18) in the direction of the clamping position, the pressure upon the abrasive sheet (16) increases.



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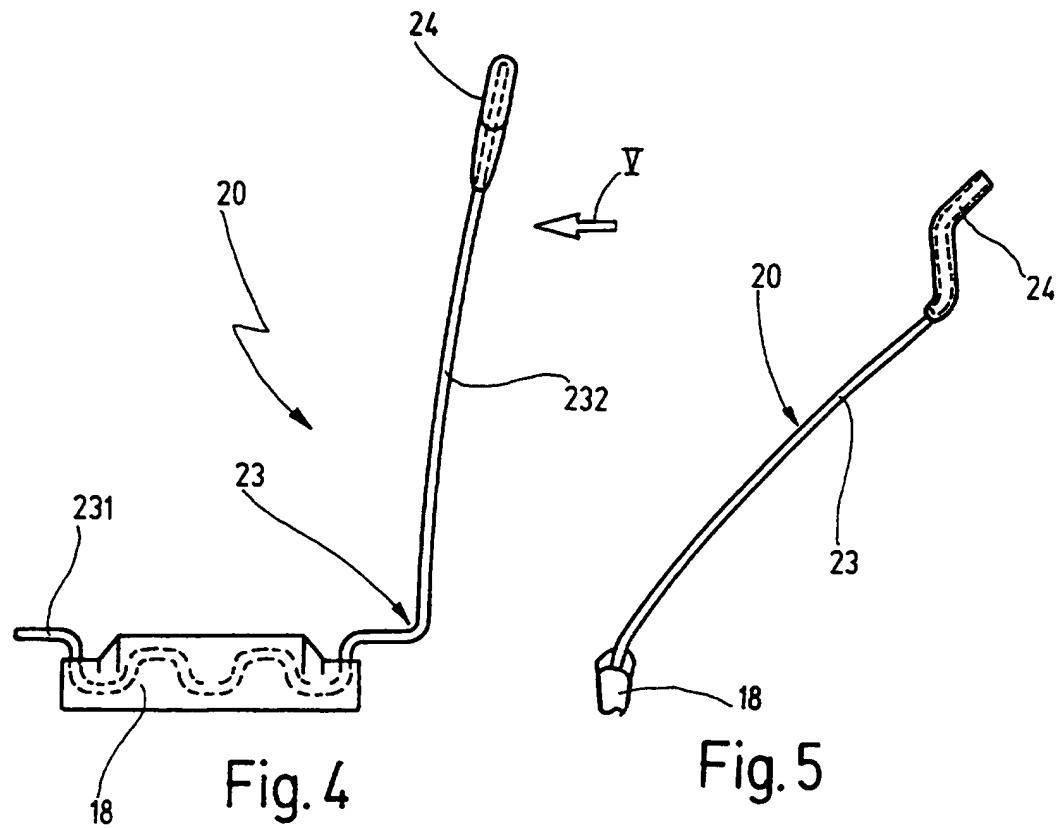


Fig. 4

Fig. 5

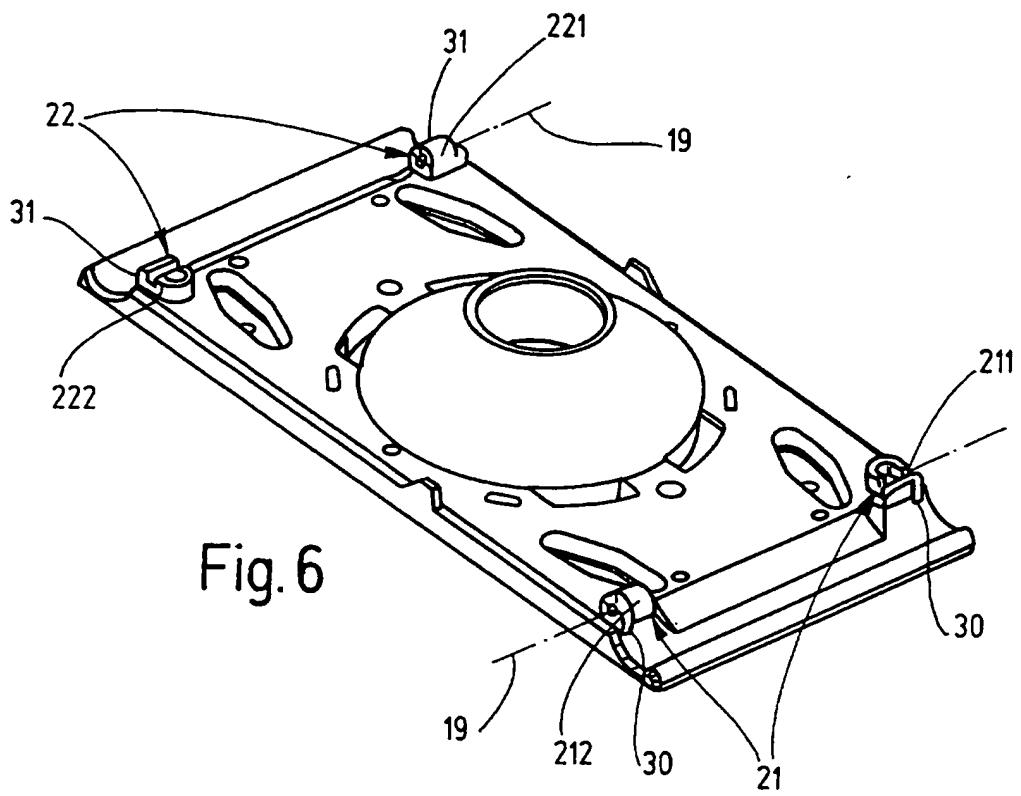


Fig. 6

Electric hand tool, in particular a sander

**Background art**

The invention relates to an electric hand tool, in particular a sander, e.g. an orbital sander, of the type defined in the preamble of claim 1.

In a hand sander of said type (DE 19 38 350 A1), an electric motor via a gear unit sets the work plate movably suspended from the housing of the hand sander into a substantially linear or slightly curved oscillating motion within one plane. Applied to the underside of the work plate is an abrasive sheet, e.g. of abrasive paper or abrasive cloth, which, after it has been folded round the edges of the work plate which extend at right angles to the direction of oscillation, is firmly clamped by clamping means at the top side of the work plate in that clamping bodies in the two end regions of the abrasive sheet press in a frictionally engaged manner onto the outside of the abrasive sheet having the bonded abrasive product and brace the abrasive sheet against the surface of the work plate.

With such a hand sander, to achieve an optimum machining capacity it is absolutely essential for the abrasive sheet to be pulled tight in the region of the work plate to prevent a movement between abrasive sheet and work plate from impairing the abrasive sheet movement relative to the workpiece because otherwise the abrasion capacity of the hand sander is drastically reduced. Mostly it is a matter of how skilfully the user inserts the abrasive sheet. But also, in the course of working with the hand sander after correct clamping of the abrasive sheet, the tension of the abrasive sheet relaxes so that from time to time the tension of the abrasive sheet has to be readjusted by releasing the clamping means and tightening the abrasive sheet.

### Advantages of the invention

The electric hand tool according to the invention having the features of claim 1 has the advantage that by virtue of the special geometric design of the clamping body made of an elastic material, e.g. an elastomer, not only is the abrasive sheet held fast and transported when lightly clamped by the applied clamping body surface but also, after completion of the clamping process, the abrasive sheet is held fast and clamped by the pressure arising between clamping body and work plate and by the then occasioned clamping body deformation and friction. By virtue of the swivelling motion of the clamping body about its eccentrically disposed swivelling axis, the abrasive sheet is drawn and tensioned and at the same time an increasing pressure is generated, the abrasive grains of the abrasive sheet as the pressure increases digging to an ever greater extent into the elastic clamping body.

The tension regulating effect of the clamping body is intensified when, according to a preferred embodiment of the invention, the clamping body is provided with two parallel tensioning or drawing lips, which are formed by introducing a longitudinal groove into the roller-like clamping body. Said tensioning or drawing lips, upon initially only light clamping of the abrasive sheet, effect an early gripping of the abrasive sheet at its surface bearing the bonded abrasive product and ensure a gentle and uniform drawing-in of the abrasive sheet.

Advantageous developments and improvements of the electric hand tool indicated in claim 1 are possible by virtue of the measures outlined in the further claims.

According to an advantageous embodiment of the invention, there is associated with the clamping body a recess with a rounded contour, which is disposed in the work plate and into which the clamping body engages upon transfer into its

clamping position, in which it clamps the abrasive sheet. The pressure is intensified by said constructional measure, especially when the contour of the clamping body is of a spiral design and so, during swivelling of the clamping body, the contact ratio of clamping body contour and recess contour increases. The surface of the recess is, in said case, smooth to enable easy sliding of the abrasive sheet upon regulation of the tension.

According to an advantageous embodiment of the invention, clamping body and recess are disposed at the top side of the work plate in such a way that, upon clamping in of the abrasive sheet, its sheet end, which is conveyed over the top outer edge of the work plate adjacent to the recess, comes to lie between recess and clamping body. Said top outer edge is rounded, as is the opposing, bottom outer edge of the work plate. By virtue of said constructional measures it is ensured that the abrasive sheet is not bent when it is folded around the outer edges of the work plate. A bend would lead to premature failure of the abrasive sheet during sanding (predetermined breaking point) and prevent the sheet from being pulled tight in the region of the work plate. The abrasive sheet may be easily drawn, and hence tightened, over the preferably gently rounded top and bottom outer edges.

According to an advantageous embodiment of the invention, the clamping body is seated on a tension lever, which is pivotally accommodated at the top side of the work plate in a bearing arrangement which is aligned with the swivelling axis. The leaf spring-like tension lever is clampable under initial tension at a housing part of the electric hand tool carrying the work plate and lends the clamping body the necessary pressing force for pressing the abrasive sheet against the work plate.

According to an advantageous embodiment of the invention, the tension lever is

a wire bent at right angles, of which one wire limb has the clamping body and the other wire limb has a handle made of elastic material injection-moulded or expanded thereon. The one wire limb is, in said case, preferably bent in an undulating or meander-like manner in the region around which the clamping body is injection-moulded or expanded.

According to an advantageous embodiment of the invention, stop ribs for the transversely extending end edges of the abrasive sheet are disposed on the work plate in such a way that, when the one sheet end is applied with its end edge against the one stop ribs, the other sheet end lies, with enough sheet length for clamping, between recess and clamping body.

According to an advantageous embodiment of the invention, the work plate comprises an oscillating plate, which executes an oscillating motion, and a sanding plate fastened to the oscillating plate, the clamping body and the recess being disposed on the oscillating plate. The clamped abrasive sheet overlaps the underside of the sanding plate.

#### Drawings

There now follows a detailed description of an embodiment of the invention which is illustrated in the drawings. Said drawings show:

Fig. 1      in a cutout manner a perspective view of an electric hand tool in the form of an orbital sander,

Fig. 2      in a cutout manner a section along the line II-II in Fig. 1,

- Fig. 3 the same view as in Fig. 2 with a firmly clamped abrasive sheet,
- Fig. 4 a front view of a clamping body with tension lever for clamping in the abrasive sheet,
- Fig. 5 a view of clamping body and tension bow in the direction of arrow V in Fig. 4,
- Fig. 6 a perspective view of an oscillating plate of the orbital sander in Figs. 1 - 3.

#### Description of the embodiment

Fig. 1 shows in a cutout manner an electric hand tool which advantageously takes the form of a hand sander, in particular an orbital sander. The electric hand tool, hereinafter referred to as orbital sander, has a housing 10, to which is fastened in an elastically movable manner a work plate 11 which may be set in oscillation by an electric motor accommodated in the housing 10 and not visible here. As the sectional view in Fig. 2 or Fig. 3 reveals, the work plate 11 comprises an oscillating plate 12, which may be set in oscillation by the electric motor, and a sanding plate 13 which is detachably fastened by means of screws (not shown) to the oscillating plate. The sanding plate 13 comprises a flexurally stiff, upper plate 14 and a lower plate 15 made of non-rigid material, e.g. foamed material, which is firmly connected to the upper plate 14. The underside of the lower plate 15 is covered by an abrasive sheet 16, e.g. of abrasive paper or abrasive cloth, the two sheet ends 161 and 162 of which are folded around the outer edges 121 and 131 - extending at right angles to the longitudinal axis of the work plate 11 - of oscillating plate 12 and sanding plate 13 and are firmly clamped at the top side of

the oscillating plate 12 by clamping means 17.

The clamping means 17, of which only the clamping means 17 for the one sheet end 161 are shown in Figs. 1 - 3, comprise a roller-like clamping body 18 made of elastically deformable material which, for applying onto the sheet end 161 or 162 or for lifting off the sheet end 161 or 162, is capable of swivelling about an eccentrically disposed swivelling axis 19. As Figs. 4 and 5 reveal, for said purpose the clamping body 18 is seated on a tension lever 20, which is pivotally accommodated at the top side of the oscillating plate 12 in a bearing arrangement 21 or 22 which is aligned with the swivelling axis 19.

Figs. 4 and 5 show two different views of the tension lever 20. The tension lever 20 is a wire 23 bent at right angles, of which one short limb 231 has the clamping body 18 and the other long limb 232 has a handle 24 made of elastic material injection-moulded or expanded thereon. The short limb 231 is bent in an undulating or meander-like manner in the region around which the clamping body is injection-moulded or expanded in order to absorb the torque which arises at the non-rigid clamping body 18 during clamping of the abrasive sheet 16 with a particular flexural strength. The tension lever 20 is inserted by the ends of the short limb 231, which project from both ends of the clamping body 18 and are aligned with one another, into the grooves of the journals 211 and 212 or 221 and 222. The handle 24 allows the tension lever 20 to be comfortably gripped for operating purposes. In the clamping position of the clamping body 18, the leaf spring-like tension lever 20 is clampable under initial tension against the oscillating plate 12, the oscillating plate 12, as Fig. 1 reveals, being provided for said purpose with a clamping hook 25, in which the prestressed tension lever 20 is fixable against the oscillating plate 12. A second clamping hook 25 for the other tension lever 20, which fixes the sheet end 162 of the abrasive sheet 16, is

disposed at the opposite side of the oscillating plate 12 and is not visible here.

Fig. 6 is a perspective view of the oscillating plate 12 with the two bearing arrangements 21, 22 for two tension levers 20. Each bearing arrangement 21 or 22 comprises two journals 211 and 212 or 221 and 222, which in each case are aligned with one another and have an, in cross section, semicircular groove for snapping the respective tension lever 20 into place.

As the sectional views in Figs. 2 and 3 reveal, the highly flexible clamping body 18 has a spiral external contour and carries two parallel, elastic drawing or tensioning lips 27, 28, which are separated from one another by a longitudinal groove 26 and, in the clamping position of the clamping body 18, are directed towards the abrasive sheet 16. Associated with the clamping body 18 is a recess 29 in the top side of the oscillating plate 12, which recess has a rounded negative contour preferably corresponding substantially to the external contour of the clamping body 18. Clamping body 18 and recess 29 are disposed on the top side of the oscillating plate 12 in such a way that, when the abrasive sheet 16 is inserted, the sheet end 161 or 162 which is drawn over the top outer edge 121 of the oscillating plate 12 comes to lie between clamping body 18 and recess 29. Fig. 2 shows the clamping body in a swivelled position, in which the abrasive sheet 16 may be inserted. For insertion, the sanding plate 13 is placed with its underside on the abrasive sheet 16 and the two sheet ends 161, 162 are folded around the rounded outer edges 131 and 121 of sanding plate 13 and oscillating plate 12 and inserted into the gap between the clamping body 18 and the top side of the oscillating plate 12. Stop ribs 30 or 31 disposed here for the end edges of the abrasive sheet 16 serve as an insertion measure for the sheet ends 161 and 162 and are so arranged that, when the one end edge of one sheet end 161 or 162 of the abrasive sheet 16 is applied against the associated stop ribs 30 or 31, the other

sheet end 162 or 161 after having been drawn over the underside of the sanding plate 13 lies with a sufficient sheet length between recess 29 and clamping body 18. When the clamping body 18 is then rotated by means of the tension lever 20 about its eccentrically disposed swivelling axis 19, namely clockwise in Fig. 2 and anti-clockwise in Fig. 1, the tensioning lips 27, 28 grip the abrasive sheet 16 and ensure a gentle and uniform drawing-in of the abrasive sheet 16. With increasing rotation, the clamping body 18 engages to a greater extent into the recess 29, with the result that the pressure on the abrasive sheet 16 increases as it is drawn in further on account of the spiral contour of the clamping body 18 and the rounded contour of the recess 29. The smooth surface of the recess 29 and the rounded outer edges 121 and 131 of oscillating plate 12 and sanding plate 13 allow easy sliding of the abrasive sheet 16 relative to the oscillating plate 12 and prevent bends from forming in the abrasive sheet 16. Since the abrasive grains of the abrasive sheet 16, as the pressure increases, dig to an ever increasing extent into the elastic clamping body 18, the abrasive sheet 16 remains clamped and is reliably secured by pressure between clamping body 18 and recess 29. Since the highly flexible clamping body 18 is deformable, said clamping of the abrasive sheet 16 is independent of the thickness of the abrasive sheet 16 so that both thin and thick abrasive sheets may be clamped and fixed in clamped position equally well.

When the clamping body 18 has reached its clamping position, the wire limb 232 of the tension lever 20 is engaged into the clamping hook 25. By virtue of the leaf spring-like curvature of the long limb 232 the wire limb 232 gets jammed at oscillating plate 12 and clamping hook 25 so that the tension lever 20 is applied under initial tension against the clamping hook 25 and the clamping body 18 is prevented from unintentional reverse rotation. The clamping position of the clamping body 18 is shown in Fig. 3. It is clearly evident that the sheet end 161

of the abrasive sheet 16 is firmly clamped between the spiral contour of the clamping body 18 and the rounded contour of the recess 29.

It may be sufficient to provide the described tension lever 20 plus clamping body 18 and the recess 29 only once in order to clamp only one of the sheet ends 161, 162 in the described manner. The other sheet end 162, 161 may be fixed in another, e.g. conventional manner. In said case also, the described advantages of simple clamping with a guaranteed taut state are achieved.

**Claims**

1. Electric hand tool, in particular a sander, e.g. an orbital sander, having a motor-driven work plate (11) and having clamping means (17) for firmly clamping on the work plate (11) an abrasive sheet (16) which overlaps the underside of the work plate (11), said clamping means comprising clamping bodies (18) which are pressable onto the sheet ends (161, 162) of the abrasive sheet (16), characterized in that at least one clamping body (18) is formed substantially in the manner of a roller from elastically deformable material and, for the purpose of applying onto and lifting off the sheet end (161), is capable of swivelling about an eccentrically disposed swivelling axis (19).
2. Electric hand tool according to claim 1, characterized in that the eccentricity of the swivelling axis (19) is fixed in such a way that the clamping body (18) upon being applied onto the sheet end (161) is elastically braceable.
3. Electric hand tool according to claim 1 or 2, characterized in that the clamping body (18) has a spiral external contour.
4. Electric hand tool according to one of claims 1 to 3, characterized in that the clamping body (18) carries two parallel, elastic drawing or tensioning lips (27, 28), which are separated from one another by a longitudinal groove (26) and in clamping position are directed towards the abrasive sheet (16).

5. Electric hand tool according to one of claims 1 to 4, characterized in that associated with the clamping body (18) is a recess (29), which is disposed in the work plate (11) and into which the clamping body (18) engages upon transfer into its clamping position.
6. Electric hand tool according to claim 5, characterized in that the recess (29) has a rounded contour, which preferably corresponds substantially to the negative contour of the clamping body (18).
7. Electric hand tool according to claim 5 or 6, characterized in that the clamping body (18) and the recess (19) are disposed at the top side of the work plate (11) in such a way that, upon clamping of the abrasive sheet (16), its sheet end (161) conveyed over the top outer edge (121) of the work plate (11) adjacent to the recess (29) comes to lie between recess (29) and clamping body (18), and that the top outer edge (121) of the work plate (11) is rounded.
8. Electric hand tool according to claim 7, characterized in that the bottom outer edge (131) of the work plate (11) lying opposite the top outer edge (121) is rounded, preferably when an abrasive sheet (16) is clamped in.
9. Electric hand tool according to one of claims 1 to 8, characterized in that the clamping body (18) is seated on a tension lever (20), which is pivotally accommodated at the top side of the work plate (11) in a bearing arrangement (21) aligned with the swivelling axis (30) and is clampable under initial tension, preferably against a

clamping hook (25) of the work plate (11).

10. Electric hand tool according to claim 9, characterized in that the tension lever (20) is a wire (23) bent at right angles, of which one wire limb (231) has the clamping body (18) and the other wire limb (232) has a handle (24) made of elastic material injection-moulded or expanded thereon.
11. An electric hand tool substantially as herein described with reference to the accompanying drawings.



The  
Patent  
Office

13.

Application No: GB 9804029.8  
Claims searched: 1-11

Examiner: R.B.Luck  
Date of search: 8 May 1998

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B3D DEP

Int Cl (Ed.6): B24B 23/04 B24D 15/02

Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage		Relevant to claims
A	GB0600664	A.H.Stevens	
A	GB0201178	Innovation Specialities Co. Inc.	
A	WO92/09405	Robert Bosch GmbH	

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